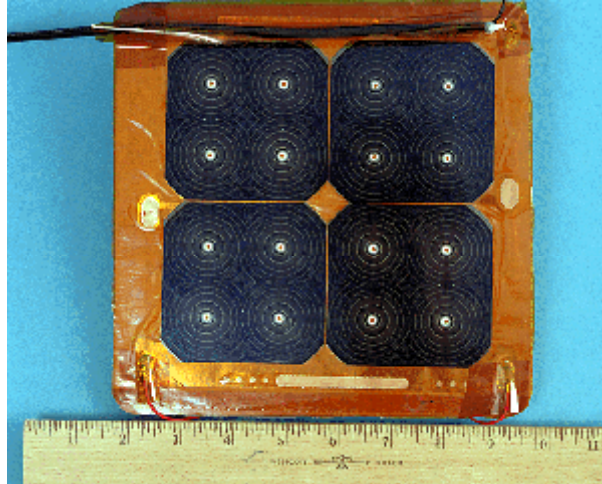


# SAMPIE Measurements of the Space Station Plasma Current Analyzed

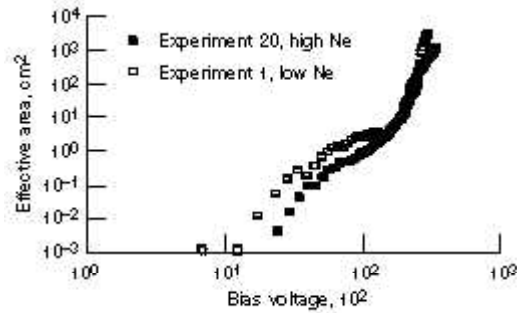


*Four-cell coupon sample of space station solar array cells.*

In March of 1994, STS-62 carried the NASA Lewis Research Center's Solar Array Module Plasma Interactions Experiment (SAMPIE) into orbit, where it investigated the plasma current collected and the arcs from solar arrays and other space power materials immersed in the low-Earth-orbit space plasma. One of the important experiments conducted was the plasma current collected by a four-cell coupon sample of solar array cells for the international space station.

The importance of this experiment dates back to the 1990 and 1991 meetings of the Space Station Electrical Grounding Tiger Team. The Tiger Team determined that unless the electrical potentials on the space station structure were actively controlled via a plasma contactor, the space station structure would arc into the plasma at a rate that would destroy the thermal properties of its surface coatings in only a few years of operation. The space station plasma contactor will control its potentials by emitting electrons into the surrounding low-Earth-orbit plasma at the same rate that they are collected by the solar arrays. Thus, the level at which the space station solar arrays can collect current is very important in verifying that the plasma contactor design can do its job.

The SAMPIE four-cell space station coupon was mounted to the top of the experiment enclosure and oriented in the ram direction by attitude control of the Space Shuttle Columbia. In the electron-collection experiment reported here, the cells were biased at voltages varying from 0 to 300 V, relative to the space shuttle ground. An electrometer measured the electron currents the cells collected from the plasma, and the results were collected on solid state memory. These results were analyzed later when SAMPIE was returned to Earth by Columbia.



*Four-cell space station collection expected from SAMPIE.*

Other onboard instruments measured the conditions in the ambient plasma--determining the plasma density and temperature, and the potential of the space shuttle with respect to the surrounding plasma. During the space station measurements, the shuttle potential was never more than about 3 V away from the plasma through which it flew. The data obtained on electron currents to the space station cells were corrected for the plasma conditions and then could be extrapolated to the worst-case conditions expected on the full space station solar array. From this extrapolation, we found that the space station array would at worst collect much less than the 10 A for which the plasma contactor was designed, so that the plasma contactor should be fully sufficient to control the space station electrical potentials.